need;. (3) generous provision of playgrounds, under skilful supervision, with the view of encouraging a healthy corporate life in all schools; (4) the raising, at dates to be fixed by Parliament, of the present age of exemption from school attendance throughout the country (with a possible reservation of the agricultural districts), first to thirteen and then to fourteen years of age; (5) the abolition by statute of the half-time system in the textile districts; (6) the provision of various forms of educational care for young people during the critical years of adolescence; (7) the laying upon all employers of a statutory obligation to enable their younger workpeople, up to seventeen years of age, to attend courses of suitable instruction, provided or approved by the local authority of the district, and held at a time of day which would prevent those attending the classes from suffering from overstrain of body or of mind.

A MEETING of the Child Study Society was held on October 29, when a paper was read by Miss Alice Ravenhill on the results of an investigation into hours of sleep among elementary-school children. For nearly three years Miss Ravenhill has been collecting information on the question of the quantity of sleep secured by children in English elementary schools. Of 10,000 forms issued, 6,180 were properly filled up, and gave particulars as to 3500 boys and 2680 girls. A comparison between the standard hours of sleep as defined by the best authorities and an average struck from the whole of the material at command shows a deficiency of from $3\frac{1}{4}$ to $2\frac{3}{4}$ hours at each age period, a loss equivalent to one night in four among the youngest and eldest children, and to one night in five among those of intermediate ages. For example, at ages three to five years the average is 10·75 hours, against a standard of fourteen hours, and, at thirteen years, eight hours, against 10·75 hours. The evil of insufficient sleep is widespread. Parents must be roused to a sense of the importance of the subject, and the enforcement of the laws on the employment of children should be rendered obligatory upon local authorities. Sir James Crichton-Browne, who presided, emphasised the need of sufficient sleep, and pointed out that sleep repairs waste in every organ of the body, and stores oxygen in the tissues as a reserve fund against the needs of the following day.

THE Board of Education has decided to introduce a new system of organisation for the Victoria and Albert Museum. Re-organisation of the administrative arrangements for the museum has been rendered necessary by the transfer of the technological branch of the Board of Education from South Kensington to Whitehall. Hitherto the administration of the museum has been supervised and controlled by the principal assistant secretary in charge of that branch of the Board's office and the removal of that branch to Whitehall renders the continuance of that arrangement impossible at so great a distance from South Kensington. In consequence of this transfer the Board decided to take the opportunity of placing the museum on an independent basis, equipped with the necessary administrative as well as technical machinery and staff. A new post has therefore been established under the title of "Director and Secretary of the Art Museum," the holder of which will, in future, be directly responsible to the Board, with assistance from the advisory council, for the whole administration of the museum and for the working of its staff. To this post the President of the Board has appointed Mr. Cecil H. Smith, of the British Museum. Mr. A. B. Skinner will take charge of a new department of architecture and sculpture to be created in the museum. It has been decided to classify the collections as far as possible by materials, and to constitute the following eight departments:—(1) architecture (original architectural objects and sculpture); (2) metalwork; (3) woodwork and leatherwork; (4) textiles; (5) ceramics, enamels, and glass; (6) engraving, illustration, and design; (7) the library; (8) pictures. Arrangements have further been made in the new and old buildings of the museum by which the staff attached to each of the eight departments will be provided with suitable offices in close proximity to the collections respectively under their charge.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 25.—"The Emission and Transmission of Röntgen Rays." By G. W. C. **Kaye.**

The Röntgen rays produced by some twenty elements used as anti-kathodes were investigated.

(1) The relative intensities of the radiations, when unobstructed by any screen, do not follow the order of the atomic weights of the anti-kathodes.

(2) If the different radiations are cut down by screens of increasing thickness, the intensities reach ultimate relative values which are not altered by a further increase in the thickness of the screen: thus at this stage all the radiations have the same hardness. These intensities are very approximately proportional to the atomic weights of the radiators. The relative values of the heavy-atom metals increase somewhat with a rise in potential on the tube.

(3) When screen and radiator are of the same metal, selective transmission of the radiation is manifested, that is, the radiation from the metal is augmented relative to the radiations from other anti-kathodes. The effect is also present to a less extent when radiator and screen have closely adjoining atomic weights.

(4) This augmentation, when radiator and screen are alike, is most pronounced in the case of the metals of the chromium-zinc group. It is least marked for a substance of low atomic weight.

(5) When screen and radiator are alike, the absorption per unit mass of unit area of the screen is relatively low. Benoist's "transparency" curve is much straighter for a radiator of aluminium than for one of platinum working under the same conditions. With an anti-kathode belonging to the chromium-zinc group the curve has to be modified by the addition of a sharp maximum in the neighbourhood of the radiator.

(6) The question of the anomalous results obtained with the secondary radiation from nickel is gone into.

(7) The curve of transmission in which the thickness of screen is plotted as abscissa against the logarithm of the intensity consists of three parts when radiator and screen are of the same metal. First, with thin screens, there is a relatively steep portion, which for thicker screens is followed by a straight-line region indicative of an exponential absorption; this again is ultimately succeeded by a region in which the slope gradually diminishes with the thickness of the screen. The preliminary steepness is attributed to secondary radiation; the ultimate flattening of the curve is probably due to scattering of hard primary rays. If the potential on the tube is not very high the absorption curve indicates homogeneity throughout its length.

(8) When screen and radiator have very different atomic weights, the region of exponential absorption does not appear.

Received August 6.—"The Rate of Production of Helium from Radium." By Sir James **Dewar,** F.R.S.

Some time ago the author communicated a paper to the society entitled "Note on the Use of the Radiometer in observing Small Gas Pressures: Application to the Detection of the Gaseous Products produced by Radio-active Bodies" (Roy. Soc. Proc., A, vol. lxxix., p. 529, 1907). In the course of the experiments recorded in that paper it was shown that a pressure of the fifty-millionth of an atmosphere could easily be detected by radiometer motion, and that the helium produced by radio-active processes from some 10 milligrams of bromide of radium could be definitely detected after a few hours. This led the author to desire some direct measurements of the amount of helium produced by radium, and through the kindness of the Royal Society in allowing him the use of some radium chloride belonging to them, he is able to give a condensed abstract of the experimental results so far obtained.

The salt employed was the 70 milligrams of radium chloride prepared by Dr. T. E. Thorpe, F.R.S., for his determination of the atomic weight of radium, the preparation of which is fully described in Roy. Soc. Proc., vol. lxxx., p. 298.

The apparatus used for the measurements was a McLeod

gauge, in the construction of which no india-rubber joints were used, the mercury reservoir being connected to an exhaust pump, while the elevation and lowering of the mercury was carried out by admitting and exhausting air in the reservoir. The air coming in contact with the mercury was purified by passage over stick-potash and phosphoric anhydride. Sealed on to the gauge was a long U-tube containing a ¼ gram of cocoa-nut charcoal placed in a small enlargement at the bend, the whole being arranged for liquid air or other cooling for any desired length of time. The object of the use of this cooled charcoal is to take up and condense all adventitious gases, other than hydrogen or helium, which might arise from minute leakage or otherwise be generated in the apparatus.

Starting with an exhaustion of 0·000054 mm. in 1100 hours, apart from intermediate irregularities, the total quantity of permanent gas produced per gram of radium per day did not exceed 0·42 cubic mm. As in this experiment the emanation had free play over the whole surface of the McLeod gauge during a fortnight when the laboratory was closed, a second one was carried out, keeping the charcoal U-tube in liquid air during the whole course of the observations, which lasted six weeks. It was now found that, with the exception of the occlusion of the helium in the radium salt and its immediate surroundings, all the anomalies of the first experiment had disappeared, and the steady increment of helium (as shown by the graphical diagram given in the paper) amounted to 0·37 cubic mm. The spectroscopic examination of the gas showed that the helium was pure, and this result was confirmed by observing the reduction in pressure caused by cooling the radium salt and also the charcoal in liquid hydrogen.

The author is not aware of any previous direct measurements of the rate of production of helium from radium, but in a paper on "Some Properties of Radium Emanation," by A. J. Cameron and Sir William Ramsay (Chem. Soc. Jour., 1907, p. 1274), the ratio of the amount of helium produced to that of the emanation was found to be 3·18, and as the amount of the emanation found by them was about 1 cubic mm. per gram of radium per day, the resulting helium, according to this experiment, ought to reach about 3 cubic mm., or at least eight times the rate of production found in the above experiments. The author is at a loss to explain the origin of such grave discrepancies in the measured amount of the helium produced by radium.[1] On the other hand, Prof. Rutherford, in his work entitled "Radio-active Transformations," 1906, p. 186, on the theoretical assumption that the α particle is an atom of helium carrying twice the ionic charge, deduced from electrical measurements that the number of particles expelled per year per gram of radium would reach 4×10^{18}, and as 1 c.c. of a gas at standard temperature and pressure contains $3{\cdot}6\times10^{19}$ molecules, the volume of helium produced per year would amount to 0·11 c.c., which is equivalent to about 0·3 of a cubic mm. per day. Considering that the author has found a rate of helium production of the order of 0·37 cubic mm., the agreement between experiment and the theoretical prophecy of Rutherford is almost too wonderful, substantiating as it does the accuracy of the theory of radio-active changes he has done so much to initiate and develop.

PARIS.

Academy of Sciences, October 26.—M. Bouchard in the chair.—Observations of the comet 1908*c* made at the Observatory of Bordeaux with the 38 cm. equatorial: Luc **Picart.** The observations were made on the nights of October 7, 10, 12, 13, and 17, the apparent positions of the comet and the positions of the comparison stars being given in tabular form. From October 7 to 18 the comet appeared as a feeble nebulosity, without a nucleus, rendering the determination of its exact position difficult. On October 12 the tail was clearly visible, with a length of about two degrees; on the following night the comet presented its usual form.—Observations of the comet 1908*c* made at the Observatory of Marseilles with the Eichens 26 cm. equatorial: M. **Borrelly.** Details are given of observations made on September 12, 15, 16, 17, and October 2 and 3. The changes in form were studied by means of seven photographs.—A first series of photographs of the Morehouse comet obtained with the large telescope at Meudon: L. **Rabourdin.** These photographs were taken on the nights of October 14, 16, 17, 20, 22, and 23 with the telescope of 1 metre aperture. The photographs do not indicate the complete development of the comet, but show the nucleus and portions of the tail. The central nucleus appears to be surrounded by several envelopes, each having its prolongation on the side opposed to the sun.—A theoretical explanation of the experiments of M. Birkeland: Carl **Störmer.** Four photographs are given showing a wire model representing a kathode bundle under the action of a small magnetic globe.—Contribution to the study of lenses: G. **Maltézos.** A theoretical investigation of the equations between the distances of the lens, supposed spherical, from the first luminous point and its secondary images produced by successive reflections and refractions at the surfaces of the lens.—A monotelephone of great sensitiveness and with its note capable of regulation: Henri **Abraham.** A modification of the Mercadier telephone, in which the soft iron plate is replaced by a strong disc of tempered steel. The Mercadier disc is replaced by a small sheet of iron, just sufficiently large to cover the electromagnet, and this is carried by two parallel steel wires. With a rhythmic current in unison with the proper note of the instrument the sensibility is much greater than with ordinary telephones. The note can be varied at will by altering the tension of the steel wires.—Induction and the probable cause of polar aurora: P. **Villard.**—The magnetic properties of metallic oxygen radicals: P. **Pascal.** A study of the magnetic properties of salts of metals which form both acid and basic oxides.—Mercurous nitrate as a microchemical reagent for arsenic: G. **Denigès.** The arsenic compound is converted into arsenic acid, and drops of this solution submitted to the action of a solution containing 10 grams of crystallised mercurous nitrate, 10 c.c. of nitric acid of specific gravity 1·39, and 100 c.c. of distilled water. Characteristic crystals are produced. The smallest amount of arsenic observable by this method is not stated.—Some oxydase phenomena produced by colloidal iron ferrocyanide: J. **Wolff.**—The action of bromine on ether: monobromaldehyde: Ch. **Mauguin.** Bromine reacts on moist ether in presence of light, considerable quantities of monobromaldehyde being produced. The aldehyde is best isolated by means of the condensation compound formed with urethane, the yield being sufficiently good for the reaction to serve as a good method of preparation of this aldehyde.—New researches on bakanosine: Em. **Bourquelot** and H. **Hérissey.** This glucoside is extracted from a Strychnos called Bakanko by the natives of Majunga, Madagascar. The physical and chemical properties of the pure alkaloid are given, the formula being

$$C_{16}H_{23}O_8N+H_2O.$$

—The transformations of the chromogenic material of grapes during ripening: J. **Laborde.**—Cedrelopsis: M. **Costantin** and H. **Poisson.**—The preservation of the cocoa-nut: M. **Dybowski.** The present method of treating copra causes serious deterioration owing to the action of micro-organisms on the albumin and fat. It has been found that this can be entirely prevented by treating the copra with gaseous sulphur dioxide.—The Plumulariidæ of the *Challenger* collection: Armand **Billard.**—The mobility and dissemination of infected dust due to the disturbance of dried tuberculous sputum: G. **Küss.** A study of the mode of dissemination of infected dust, produced by slowly drying the sputum of tuberculous patients in the dark under conditions approximating to those which occur in practice. The quantity of infected dust produced is very small compared with the quantity of sputum. When the dust is caused by slight shaking or beating of an infected carpet, these powders are only projected for a short distance above the carpet. They are, however, sufficiently light to remain in suspension in the air for from

[1] Prof. Rutherford, in a paper, "Experiments with Radium Emanation," Phil. Mag., July, 1908, shows this result is at least ten times too great, his value being of the order 0·11 cub. mm. of emanation per day, whereas from the author's experiments the rate of helium production is just three times this amount.

ten to fifteen minutes, and during that time can be carried by currents of air about the room.—An infection of the gondi (*Ctenodactylus gondi*) with the Leishman or a similar organism: C. **Nicolle** and L. **Manceaux.**—The preponderating *rôle* of geometry in topographical examinations: M. **Contremoulins.** A discussion of the application of geometrical principles to practical radiography. The author arrives at the following conclusions:—the distance of the radiating focus from the photographic plate should be constant for all radiographic examinations, the normal incidence ought to be inscribed automatically in the course of the examination on the plate, the attitude in which the subject has been radiographed ought to be mentioned on the proof, and, whenever possible, two radiographs should be taken forming two planes of projection at an angle of 90°.

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), part iii. for 1908, contains the following memoirs communicated to the society:—

May 16.—The formal relations of quadrilaterals composed of circular arcs: W. **Ihlenburg.**—New developments in linear differential equations: E. **Hilb.**—A new method of solution of certain boundary-value problems: W. **Ritz.**—The application of integral equations to the problem of Riemann: E. E. **Levi** (Pisa).

June 27.—The influence of a naturally active body on light reflected from it: K. **Försterling.**—The decomposition of an empirically given periodic function into series of sines: C. **Runge.**—The reduced differential equations of a heavy unsymmetrical top: P. **Stäckel** (Karlsruhe).

July 11.—Researches from the University chemical laboratory of Göttingen, xx. (1) Transformation of nopinone ($C_9N_{14}O$) into β-pinene ($C_{10}H_{16}$), camphene, and camphor ($C_{10}H_{16}O$); (2) the alcohols of the terpinene series; (3) the modifications of terpinene: O. **Wallach.**

July 25.—Formulæ for the reflection of light at a thin metallic film: W. **Voigt.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 5.

ROYAL SOCIETY, at 4.30.—(1) Note on Tidal Bores; (2) Vortices in Oscillating Liquid: The Lord Rayleigh, O.M., Pres. R.S.—Note on Two recently-compiled Calendars of Papers of the Period 1666–1806 in the Archives of the Royal Society: Prof. A. H. Church, F.R.S.—On the Generation of a Luminous Glow in an Exhausted Receiver moving near an Electrostatic Field, and the Action of a Magnetic Field on the Glow so produced, the Residual Gases being Oxygen, Hydrogen, Neon and Air: Rev. F. J. Jervis-Smith, F.R.S.—The Rate of Production of Helium from Radium: Sir James Dewar, F.R.S.—The Spectrum of Radium Emanation: A. T. Cameron and Sir William Ramsay, K.C.B., F.R.S.—On the Osmotic Pressures of Aqueous Solutions of Calcium Ferrocyanide. Part I., Concentrated Solutions: The Earl of Berkeley, F.R.S., E. G. J. Hartley, and C. V. Burton.—The Effect of Pressure upon Arc Spectra. No. 2, Copper: W. G. Duffield.—On a Method of Comparing Mutual Inductance and Resistance by the Help of Two-phase Alternating Currents: A Campbell.

CHEMICAL SOCIETY, at 8.30.—The Direct Union of Carbon and Hydrogen: W. A. Bone and H. F. Coward.—The Relation between Absorption Spectra and Chemical Constitution. Part XI., Some Aromatic Hydrocarbons: E. C. C. Baly and W. B. Tuck.—Organic Derivatives of Silicon. Part VII., Synthesis of *dl*-Sulphobenzylethylisobutylsilicyl Oxide: B. D. W. Luff and F. S. Kipping.—(1) Chlorine Derivatives of Pyridine. Part IX., Preparation and Orientation of the Dichlor-pyridine, m. p. 66–70°; (2) Chlorine Derivatives of Pyridine. Part X., Orientation of the Trichloropyridine, m. p. 49–50°; (3) Chlorination of Methyl Derivatives of Pyridine. 2-Methyl pyridine. Part II.: W. J. Sell.—(1) The Triazo-group. Part V., Resolution of *a*-Triazopropionic acid; (2) The Triazo-group. Part VI., Triazoethyl Alcohol and Triazoacetaldehyde: M. O. Forster and H. E. Fierz.

LINNEAN SOCIETY, at 8.—Notes on some Parasitic Copepoda, with a Description of a New Species of *Chondracanthus*: May E. Bainbridge.—On some Nemerteans from the Eastern Indian Ocean: R. C. Punnett and C. Forster Cooper.—Report on the Echinoderms other than Holothurians collected by Mr. Stanley Gardiner in the Western Parts of the Indian Ocean: Prof. F. Jeffrey Bell.

RÖNTGEN SOCIETY, at 8.15.—Presidential Address, The Amsterdam Congress.

FRIDAY, NOVEMBER 6.

GEOLOGISTS' ASSOCIATION, at 8.—On some Norwegian Lakes and Rock-Basins: H. W. Monckton

TUESDAY, NOVEMBER 10.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Glasgow Central Station Extension: D. A. Matheson.

THURSDAY, NOVEMBER 12.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Charges on Ions in Gases, and the Effect of Water Vapour on the Motion of Negative Ions: Prof. J. S. Townsend, F.R.S.—The Charges on Ions produced by Radium: C. E. Haselfoot.—The Occlusion of the Residual Gas and the Fluorescence of the Glass Walls of Crookes's Tubes: A. A. Campbell Swinton.—An Investigation of the Anatomical Structure and Relationships of the Labyrinth in the Reptile, the Bird and the Mammal: Dr. A. A. Gray.—The Natural Mechanism for Evoking the Chemical Secretion of the Stomach (Preliminary Communication): Dr. J. S. Edkins and Miss M. Tweedy.—Furthur Observations on Welwitschia: Prof. H. H. W. Pearson.—On the Presence of Hæmo agglutinins, Hæmo-opsonins and Hæmo-lysins in the Blood obtained from Infectious and Non-Infectious Diseases in Man (Preliminary Communication): L. S. Dudgeon.—Preliminary Note on the Occurrence of a New Variety of Trypanosomiasis in the Island of Zanzibar: A. Edington.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Inaugural address by the President, Mr. W. M. Mordey.

MATHEMATICAL SOCIETY, at 5.30 (*Annual General Meeting*).—On the Theory of Groups of Finite Order (Presidential Address): Prof. W. Burnside.—On the Dirichlet Series and Asymptotic Expansion of Integral Functions of Zero Order: J. E. Littlewood.—The Norm Curves on a Given Base: Prof. F. Morley.—Satellite Curves on a Plane Cubic: J. O'Sullivan.—On the Arithmetical Nature of the Coefficients in a Group of Linear Substitutions (Third Paper): Prof. W. Burnside.—On the Second Mean Value Theorem of Integral Calculus: Dr. E. W. Hobson.—On the Representation of a Function by Means of a Series of Legendre's Functions: Dr. E. W. Hobson.—The Conformal Transformations of a Space of Four Dimensions and their Applications to Geometrical Optics: H. Bateman.—Periodic Properties of Partitions: D. M. Y. Sommerville.—The Solution of Integral Equations: Prof. A. C. Dixon.—The Eliminant of Three Quantics in Two Independent Variables: A. L. Dixon.—A Note on the Continuity or Discontinuity of a Function defined by an Infinite Product: G. H. Hardy.—The Energy and Momentum of an Ellipsoidal Electron: F. B. Pidduck.—On *q*-Integration: Rev. F. H. Jackson.—On *q*-Transformations of Power Series; Rev. F. H. Jackson.—The Complete Solution in Integers of the Eulerian Equation $X^4 + Y^4 = U^4 + V^4$: Dr. T. Stuart.

FRIDAY, NOVEMBER 13.

PHYSICAL SOCIETY, at 8.

MALACOLOGICAL SOCIETY, at 8.—Note on *Diplommatina strubelli*, Smith: E. A. Smith.—The Radulæ of British Helicids, Part ii: Rev. E. W. Bowell.—New Marine Mollusca from New Caledonia, &c.: G. B. Sowerby.—New Species of Macrochlamys and Monocondylæa from Siam: H. B. Preston.—A New Species of Oliva: F. G. Bridgman.

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